Amendments to the Claims

This listing of claims will replace the originally filed claims in the application.

Listing of Claims:

Claims 1 – 17 (cancelled)

Claim 18 (new): A method for ultrasonic inspection of welds, comprising:

a) applying the TOFD technique,

1. said TOFD technique comprising utilizing at least one pair of transducers;
2. said at least one pair of transducers comprising a first transducer and a second transducer;
3. said first transducer one emitting ultrasonic waves and said second transducer receiving ultrasonic waves;
4. said at least one pair of transducers moving in a direction selected from the group consisting of a longitudinal direction along the weld to be inspected and or a circumferential direction along the weld to be inspected;
5. said at least one pair of transducers being positioned laterally on either side of the weld to be inspected; and
6. said at least one pair of transducers comprising piezoelectric crystals or ceramics, so as to detect any flaw in the weld located at a first depth of at least about 5 mm; and

b) applying a creeping wave technique, wherein said creeping wave technique comprises:

1. moving at least one third transducer along the weld to be inspected so as to detect any flaw in said weld located at a second depth of between about 0.5 mm and about 15 mm; and
2. injecting sound into at least part of the weld to be inspected with at least one longitudinal sound wave from said third transducer inclined at an angle (β) of between about 70° and 90° of an angle of refraction, or at a frequency of between about 1.5 MHz and about 4 MHz.

Claim 19 (new): The method of claim 18, wherein said welds further comprises joining two metal workpieces edge to edge.

Claim 20 (new): The method of claim 18, wherein said first transducer and said second transducer are selected from the group consisting of:

a) piezoelectric crystals;

b) ceramics of rectangular shape; and

c) ceramics of oblong shape.

Claim 21 (new): The method of claim 18, wherein said ultrasonic transducers have a frequency band greater than about 60% of the central frequency and a frequency between about 1 MHz and about 20 MHz.

Claim 22 (new): The method of claim 18, wherein said ultrasonic transducers have a frequency band greater than 60% of the central frequency and a frequency between about 6 MHz and about 18 MHz.

Claim 23 (new): The method of claim 18, further comprising the lateral shift of said pair of ultrasonic transducers relative to the center of the weld.

Claim 24 (new): The method of claim 18, wherein said first depth is about 10 mm.

Claim 25 (new): The method of claim 18, wherein said first depth is between about 10 mm and 300 mm.

Claim 26 (new): The method of claim 18, wherein said first depth is between about 10 mm to 60 mm.

Claim 27 (new): The method of claim 18, wherein said frequency is about 2 MHz.

Claim 28 (new): The method of claim 18, wherein said creeping wire technique comprises injecting sound into at least part of the weld to be inspected with at least one longitudinal sound wave from said third transducer inclined at an angle (β) of about 76° of angle of refraction, or at a frequency of between about 1.5 MHz and about 4 MHz.

Claim 29 (new): The method of claim 28, wherein said frequency is about 2 MHz.

Claim 30 (new): The method of claim 18, wherein step b) is carried out in succession on each side of the weld to be inspected.

Claim 31 (new): The method of claim 18, wherein, in step b), any flaw in the weld located at a depth of between about 0.5 mm and about 20 mm is detected.

Claim 32 (new): The method of claim 18, wherein, in step b), any flaw in the weld located at a depth of between about 0.5 mm and about 10 mm is detected.

Claim 33 (new): The method of claim 18, wherein said at least one third transducer comprises a wave-emitting ceramic allowing sound waves to be emitted in the direction of the weld and an ultrasonic wave receiving ceramic for receiving ultrasonic waves.

Claim 34 (new): The method of claim 18, further comprising a calibration phase in which said ultrasonic transducers are calibrated on the basis of a calibration notch of defined depth, said notch simulating a crack.

Claim 35 (new): The method of claim 34, wherein said calibration notch has a length of about 10 mm and a depth of about 1 mm.

Claim 36 (new): The method of claim 18, further comprising at least one analysis step in which at least one signal received by at least one receiving transducer is analyzed, said analysis being performed while the weld is being scanned, said analysis resulting in a result selected from the group consisting of:

a) the detection of any flaw;
b) the detection of any crack
c) the determination of the flaw depth;
d) the determination of the flaw length
e) the evaluation of the flaw depth; and
f) the evaluation of the flaw length.

Claim 37 (new): The method of claim 19, wherein:

a) said workpieces comprise a thickness, wherein said thickness is between about 5 mm and about at least 60 mm; and

b) said workpieces being selected from the group consisting of:

1) walls of equipment;
2) components operating under pressure;
3) part of a chemical unit;
4) part of a petrochemical unit;
5) part of a nuclear power station;
6) structures of flying machines;
7) elements of rotating machines;
8) components of rotating machines;
9) pipes;
10) railroad rails; and
11) any all-welded assembly.

Claim 38 (new): An apparatus for implementing the method of inspection of welds of claim 18, comprising:

a) at least one pair of transducers,

1) said at least one pair of transducers comprising a first and a second transducer;
2) said first transducer emitting ultrasonic waves;
3) said second transducer receiving ultrasonic waves;
4) said at least one pair of transducers generating a measurement signal;
5) said at least one pair of transducers using at least one of piezoelectric crystals or ceramics;
6) said at least one pair of transducers being mechanically linked via a common support, wherein said common support comprises a rod linkage system which is designed to hold the transducers apart a certain distance and to allow this distance to be adjusted as desired; and
7) common support being connected to a liquid inlet for acoustic coupling of these transducers with the weld to be inspected;

b) at least one third transducer; and

c) processing means for processing said measurement signal, said transducers being connected to said measurement processing means.

Claim 39 (new): The apparatus of claim 38, wherein said liquid comprises water.

Claim 40 (new): The apparatus of claim 38, wherein said rod linkage further comprises a pivoting arrangement for pivoting each transducer, said rod linkage further comprising a locking means for locking in a chosen angular position.

Claim 41 (new): The apparatus of claim 38, wherein said common support further comprises an arrangement allowing said pair of transducers to undergo a lateral shift relative to the center of the weld to be inspected.

Claim 42 (new): The apparatus of claim 38, wherein said third transducer further comprises:

a) a wave emitting ceramic; and

b) a sound wave receiving ceramic.